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PRECISE VACUUM STABILITY BOUND IN THE STANDARD MODEL

addendum

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The results of this paper (Phys. Lett. B317, 159 (1993)) were given for top quark masses between 120 and 160 GeV. Here, I include the results for masses between 160 and 190 GeV. The procedure is unchanged The results, corresponding to Eq. 8, are now given by

$$m_H > 132 + 2.2(m_t - 170) - 4.5\left(\frac{\alpha_s - 0.117}{0.007}\right)$$

in units of GeV. This matches the previous result for $m_t = 160$ GeV. The slightly greater dependence on the strong coupling is due to the larger Yukawa coupling. This is accurate to 1 GeV in the top mass and 2 GeV in the Higgs mass. Thus, discovery of the Higgs boson in the next few years at LEP 200 would rule out the standard model if one requires that the vacuum be stable up to very large scales (we used the scale of 10^{15} GeV–the precise value doesn't much matter). If the vacuum is unstable, the early universe would enter the true vacuum (ruling out the model) unless the Higgs mass is within 5 GeV of the bound, as indicated in Fig. 2 of the paper.